K^* production in Cu+Cu and Au+Au collisions a $\sqrt{s_{\rm NN}}$= 62.4 GeV and 200 GeV in STAR

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Abstract

We report the measurements of p_T spectra of K^* up to intermediate p_T region in mid-rapidity through its hadronic decay channel using the STAR detector in Au+Au and Cu+Cu collisions at $\sqrt{s_{\rm NN}}$= 62.4 GeV and 200 GeV. Particle ratios such as K^*/K and K^*/ϕ is used to understand the rescattering and regeneration effect on K^* production in the hadronic medium. The K^* v_2 measurement using a high statistics Au+Au 200 GeV dataset and nuclear modification factor measurement supports the quark coalescence model of particle production in the intermediate p_T range.

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1 Introduction

The main motivation for studying heavy ion collision at high energy is the study quantum chromodynamics in extreme conditions of high temperature and high ene density[1]. One of the proposed signatures of a possible phase transition of nuclear ma to deconfined state of quarks and gluons is the modification of vector meson produc rates and their in-medium properties[3]. K^* meson is of particular interest due to very short life time and its strange quark content, which makes K^* meson sensitive to properties of the dense matter and provide information regarding strangeness produc from early partonic phase[2][8]. The study of K^* meson provides a better understand on the role of rescattering and regeneration effects in hadron production. The interp of these two competing processes is guaged through particle ratio studies of K^*/K^- ϕ/K^* in $p+p$ and nucleus-nucleaus collisions. The mass of K^* is close to the mas

the observed differences between the R_{CP} of K_S and Λ are due to difference in their n
or baryon-meson effect[7]. In the intermediate p_T range,the identified hadron elli
flow v_2 measurements have shown that the hadronic v_2 follows a simple scaling of
number of constituent quarks in the hadrons. The K^* v_2 measurement may reveal
K^* production mechanism in hadronic phase[2].

2 Experiment and Data Analysis

The results discussed here are taken from Au+Au and Cu+Cu collisions at $\sqrt{s_{\rm NN}}$=
GeV and $\sqrt{s_{\rm NN}}$= 62.4 GeV at RHIC. The Time Projection Chamber[4] within ST
was used to measure the K^* production via its hadronic decay channel. The unlike s
Kπ invariant mass distribution was reconstructed eventwise from random combina
of Kπ pairs. The combinatorial background distribution was built by using mixed-ev
technique[9]. The mixed event generated was normalized to subtract the backgroun
the same event unlike-sign invariant mass spectrum. The K^* signal was observed a
subtracting the normalized mixed event background from the unlike sign spectrum.

Figure 1: The Kπ pair invariant mass spectrum after mixed-event background subt
tion fitted to SBW + RB(Left panel) and p_T spectra in Au+Au collisions at 62.4 G
fitted to an exponential function(Right panel).

3 Results

Figure 1(left panel) shows the unlike sign Kπ invariant mass spectrum after normal
mixed event background subtraction in minimum bias Au+Au collisions at $\sqrt{s_{\rm NN}}$=
GeV. The invariant mass distribution is fitted to the function SBW + RBG where S
is the non relativistic Breit-Wigner function and RBG is the linear function describ

$\sqrt{s_{\rm NN}}$= 62.4 GeV. Figure 2(left panel) depicts the K^{*0}/K^{-} ratio normalized by t values in p+p collisions at the same beam energy. The decrease of the ratio with number of participants indicates that the rescattering of the decay particles domin over resonance regeneration. In Figure 2(right panel), we observe an increase of $\phi/$ ratio normalized by their values in p+p collisions with number of participants.This a favours dominance of rescattering effect on K^{*}.

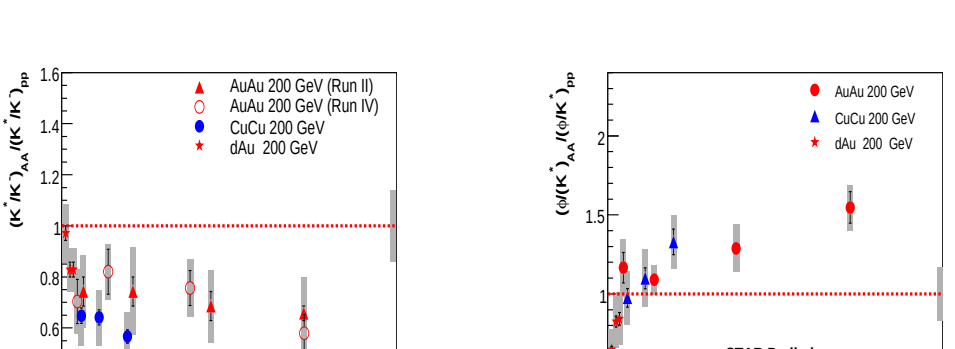

Figure 2: K^{*0}/K^{-} ratio (left panel)and ϕ/K^{*0} ratio(right panel) normalized by t values in p+p collisions at 200 GeV as a function of number of participants.The error b correspond to statistical errors whereas the error bands are systematic uncertainities. width of band(right)at value 1 on y-axis represents the error in K^{*0}/K^{-} in p+p collisi

Figure 3(left panel) shows the K^{*0} R_{CP} as function of p_T compared to the Λ and R_{CP}. For $p_T < 1.8$ GeV/c, the K^{*0} R_{CP} in Au+Au collisions at 200 GeV and 62.4 G are smaller than that of Λ and K^0_S, indicating strong rescattering of K^{*0} decay parti at low p_T. For $p_T > 1.8$ GeV/c, the K^{*0} R_{CP} in Au+Au collisions at 200 GeV is m closer to the K^0_S R_{CP} which favours a baryon-meson effect of the particle productio the intermediate p_T region.

Figure 3 shows K^{*0} elliptic flow v_2 as a function of p_T in minimum bias Au+ collisions at $\sqrt{s_{\rm NN}}$= 200 GeV. It was fit with function[10]:

$$v_2(p_T, n) = \frac{an}{1 + exp(-(p_T/n - b)/c)} - dn$$

where a, b, c and d are fixed parameters extracted by fitting K^0_S and Λ v_2 data point reference[10],and n is an open parameter representing the number of constituent qua Fitting the K^{*0} v_2 data with function given in Eqn.1 gives a value of $n = 2.0 \pm$ with $\chi^2/ndf = 2/6$. This indicates that K^{*} are dominantly produced from direct qu combinations, and K^{*} regeneration is negligible in the hadronic stage.

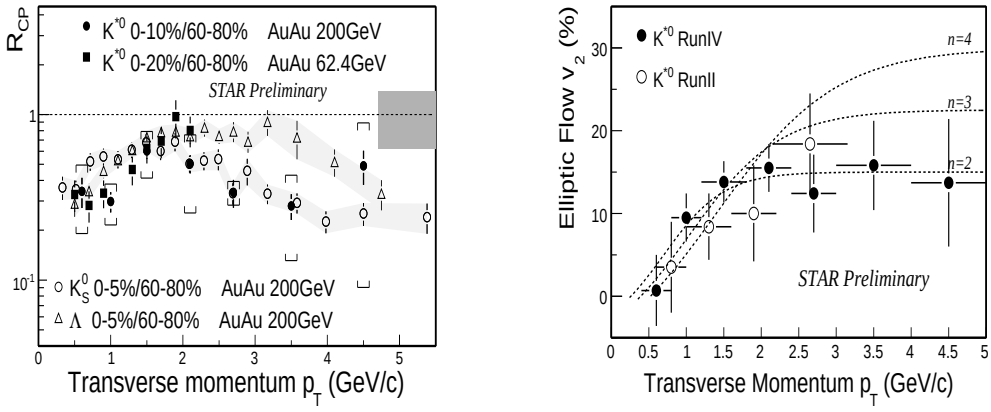

Figure 3: K^{*0} R_{CP}(left panel)as a function of p_T in Au+Au collisions at 200 GeV 62.4 GeV compared to R_{CP} of K^0_S, Λ. K^{*0} v_2 as a function of p_T in minbias Au+ collisions at 200 GeV(right panel).

4 Summary

The preliminary results on the K^* production in Au+Au and Cu+Cu collisions m sured with the STAR detector at RHIC at $\sqrt{s_{\rm NN}} = 62.4$ GeV and $\sqrt{s_{\rm NN}} = 200$ GeV presented. The particle ratio and R_{CP} measurement supports the dominance of res tering effect over the regeneration mechanism in K^* production. A significant non-z elliptic flow v_2 of K* is measured using the high statistics minimum bias Au+Au GeV data. In the intermediate p_T, the number of quarks from v_2 scaling was found be 2.0 +- 0.3 which implies that the observed K* is predominantly produced by di quark combinations.

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